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ARBORETUM BULLETIN

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LE RUISSEAU ET LES ARBRES.

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Concerning This Issue. . .

The previous issue of the *Bulletin* was the last one published under the able hand of Nancy Pascoe. After four years of participation, she has left the position of editor to spend more time with her family. Nancy's time as editor was well spent as she continuously presented us with beautiful, interesting, and readable volumes. Our best wishes to her as we look forward to spending more time with her in the Arboretum community.

The fall issue will be the first one with our new editor, Jan Silver. We welcome her and the *Bulletins* that will be coming from her desk.

This issue covers a wide range of topics. Appropriate to the season, we have palms. We even have two new palm trees at the entrance of the Arboretum greenhouse. Look for them on your next visit. There is a concise explanation of nitrogen-fixation, and we continue our pruning series by Cass Turnbull. As a special event we have a reprint by a valued compatroit in the garden, Frances Roberson; and look for a treat from George Schenk, another prominant local plants-person.

My thanks to all those people in the Arboretum environment who have been so helpful to me as I put this issue together. And as a final thought, I share with other novice gardeners, a lesson I have learned: Don't plant your delphiniums in front of your garden spigot, it makes it hard to reach. Have a grand end-of-summer!

Palma Hoppel
Interim Editor

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THE COVER
A Summer Arboreal
"Stream and Trees"
Old French book etching purchased in Arles, France. From the collection of the editor. Have you visited the water spots in the Arboretum lately?

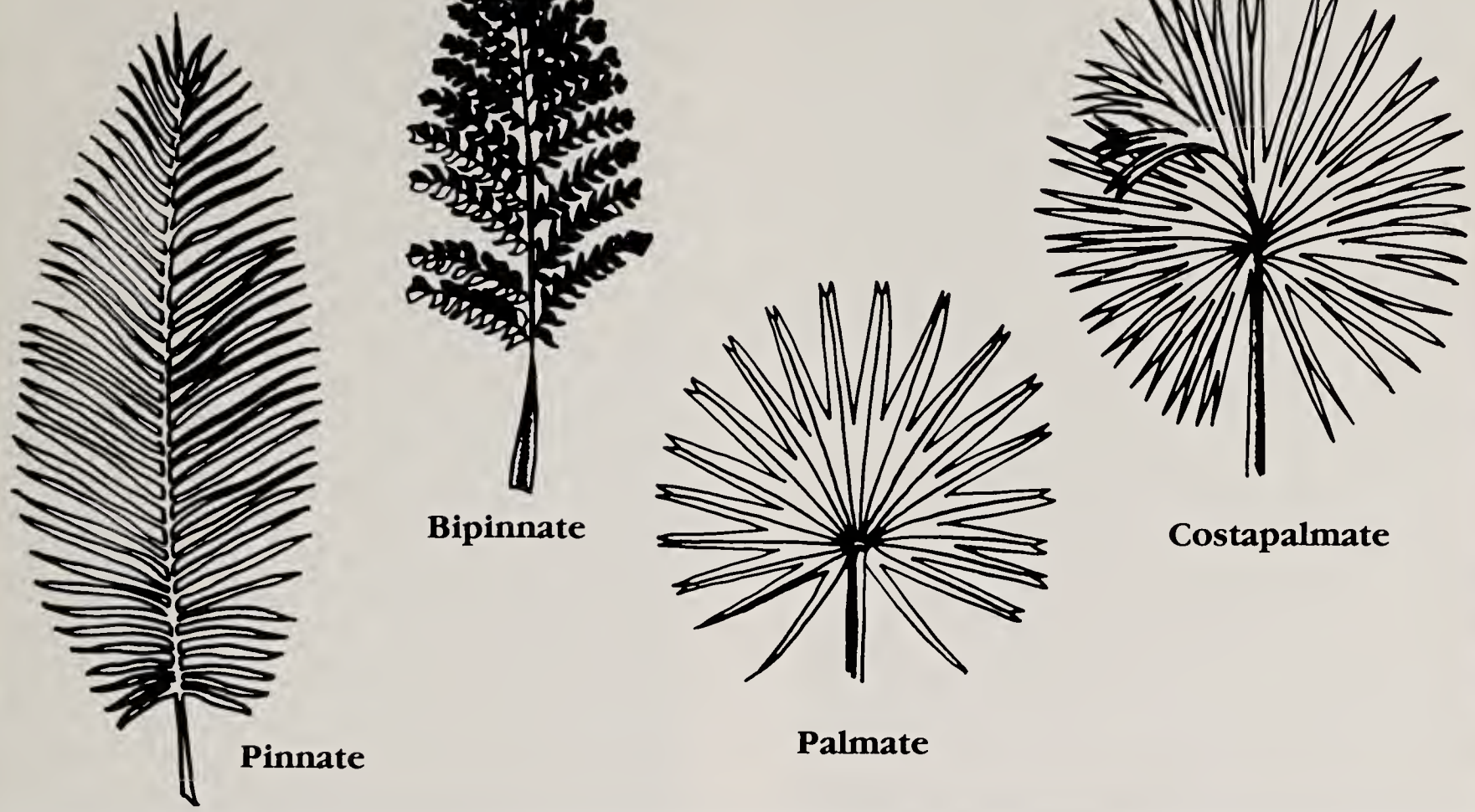
Palms for the Pacific Northwest

TIMOTHY HOHN
Curator of Plant Collections

I'll never forget seeing my first palm trees next to a small motel along an interstate highway outside of Tifton, Georgia in 1962. Compared to those seen farther down the road in Florida, they were rather a sad pair of cabbage palms, *Sabal palmetto*. Nevertheless, I was proud of my find in response to a parental challenge designed to quell the usual sibling misbehavior encountered on long road trips in a packed station wagon. Now that I think of it, this was my first experience with roadside botany, with which I am sure we are all familiar. Technically, we had been seeing palms for several miles prior to my discovery, the scrub palmetto, *Sabal minor*, but we thought they were pineapples! The roadside palm search produced only a temporary truce but left a permanent impression.

The preeminence and beauty of palms in the tropical and subtropical landscape is undeniable. Certainly no other object better exemplifies the look of a "tropical paradise" than palm trees. This probably accounts for the look of astonishment on the faces of visitors to the Pacific Northwest when they encounter the occasional palm in the landscape. Swift double takes followed by a facial expression equivalent to a mixture of oil and water usually accompany the discovery of palms in a conifer and rhododendron dominated area. *Trachycarpus fortunei*, the Chinese windmill or Chusan palm, is most often the culprit involved in these sightings. To the further disbelief of many, their survival in the Puget Sound basin, Willamette Valley, and other mild regions of the Pacific Northwest is not simply a fluke, anomaly, or miraculous result of nurturing by an over-achieving green thumb; they are perfectly hardy here! For the remainder of this article we will explore the botany and natural history of palms and then take a closer look at plants worth a try in milder regions of the Pacific Northwest.

Palms are placed in the group of flowering plants known as monocots along with grasses, lilies, etc. In fact, palms epitomize the monocots in many ways including their sympodial habit, leaves with sheathing bases and parallel venation, and flowers with a trimerous (three sepals—three petals—six stamens—three carpels) plan. The palm family, Palmae (syn. Arecaceae), is a microcosm of structural diversity—greater than that of any other monocot family (Uhl & Dransfield, 1987). They can be found as trees, shrubs, and climbers.



Leaf structure of some palms. *illustration: P. Hoppel*

One of the most distinctive features of palms is their monolithic trunk terminated by a crown of conspicuous foliage. The trunks, or stems, can be either solitary or clustered. Those of some palms never pierce the surface of the ground, giving them a shrubby appearance. Of greater interest, the stems of many palms, once fully formed, do not increase in diameter. This can be explained by the absence of a ring-like cambium which produces secondary growth rings in dicotyledonous trees and shrubs. Palms, and other monocots, have only primary tissue which is produced from the growing tip at the top of the shoot. Some palm stems never reach a diameter greater than two cm while others may be more than a meter thick. By the same token, although some palm stems may be completely subterranean, others may reach heights of 60 meters, or 180 feet (Uhl & Dransfield, 1987).

As unusual as palm stems are, it is the leaves which are the most conspicuous and distinctive. Basically, palm leaves can be simple, palmate, or fan-shaped, pinnately compound, or bi-pinnately compound, with a distinct petiole—often quite long—and a leaf sheath that encircles the stem. The largest leaves in the plant kingdom are to be found among the palms in the genus *Raphia*, its leaves often reaching 25 meters in length (Uhl & Dransfield, 1987).

As one might presume, palms are found throughout the more humid tropics and subtropics but are generally absent from deserts except where water can be found close to the surface. They occur most often in mixed tropical and subtropical forests and, occasionally, in large stands of single species. The lowland rain forests of the Sunda Shelf (much of Indonesia) and New Guinea, and Central and South America are the richest in palm species (Uhl & Dransfield, 1987). Those palms found growing under conditions most dissimilar to this general description and at the fringes of palm distribution happen to be those 14 species native to the U.S., one native to the Mediterranean area, and seven in central and eastern Asia. Those species growing at the altitudinal limits of their range also endure rigorous conditions. All of these at the fringes of distribution may be suitable candidates for Pacific Northwest gardens and some of them, in fact, are known to be hardy.

As curious and patient gardeners, we often attempt to grow plants thought to be too tender for our respective areas by discovering the factors that critically affect their hardiness and then seeking the means to control, modify, or

A Chusan palm, Trachycarpus fortunei.
photo: author

ameliorate those factors. It can be said that if successful, we are extending the physiological range (versus "ecological range") of these plants. The cultivation of palms in the Pacific Northwest constitutes an extension of their physiological range—easier with some, more difficult with others. Frost damage is the single most limiting factor that we have to contend with in our area. Careful siting of palms coupled with attention to their water and fertilizer needs, along with the elimination of competing weeds, may elevate the vigor of these plants to the point where they are more likely to tolerate low temperatures that would otherwise combine with these other limiting factors to eliminate these plants.

Palms will benefit from a south or west exposure regardless of the species we use. This siting will provide some protection from the northerly and northeasterly cold fronts that occasionally plague our area in winter. In addition, the plants will receive maximum exposure in summer for more rapid growth and maximum production and storage of carbohydrates, all of which aid in the ability of plants to withstand cold. Palms can vary markedly in their ability to survive cold based on their degree of maturity. In fact, the natural distribution of many palms is a direct result of seedling survival to varying degrees of frost. It is one thing to survive in cultivation and another to succeed in nature where setbacks retard recovery and lead to overshadowing and extermination by hardier plants (Corner, 1966). The establishment of seedlings or very young plants may require diligent observation and elaborate protection from frost.

Palms can be quite variable in growth rate although most are painfully slow in the cool summers of the Pacific Northwest. Be sure to provide adequate fertilizer for your plants at the beginning of the growing season. Palms are continually growing, depending upon the weather conditions, but produce most of their new growth, in our area, between June and October. Six month formulations of microencapsulated fertilizers applied in early May will satisfy the needs of most plants for the remainder of the warm growing season. Palms are responsive to fertilizer and can be encouraged to grow more rapidly with its use. Generally speaking, the individual plants we will examine here prefer a well drained soil. This means that most of us will have to replace or otherwise amend the soil within our planting sites. There may be some special irrigation concerns and I will address these individually.

A Conservative Palette of Palms

- *Trachycarpus* species
(Chusan or Chinese Windmill Palms)

This is the genus most often seen in our area. There are six species currently recorded from the Himalayas in northern India through the northern portion of Southeast Asia and into China. The species most commonly grown is *Trachycarpus fortunei*, thought to be the hardiest of all cultivated palms. There are beautiful specimens of this plant at the Carl S. English Gardens and the Graham Visitors Center, Washington Park Arboretum, both in Seattle. Specimens of the Chusan palm can be found growing at 50 degrees N latitude in the British Isles.

Trachycarpus fortunei can attain an impressive height in our area, perhaps as much as 30

Fiberous remains of the old leaf bases of Trachycarpus fortunei.

feet. The trunks are often very fibrous and dotted with the old, persistent leaf bases. The fronds are palmate or fan shaped, relatively flat and frequently divided to about half their width into tapered segments. The leaf stems, or petioles, are so slightly serrated as to appear smooth. To some, this palm looks like a smaller version of the Washington fan palm of California.

The Chusan palm seems to be tolerant of a wide range of soil types and grows well with varying exposures in the Puget Sound Basin. This is a rather drought-tolerant plant once it is established, although its growth rate is probably enhanced by summer irrigation.

• *Chamaerops humilis*
(Mediterranean Fan Palm)

This palm has the most northerly distribution of any and is the only palm native to Europe. It is relatively common around the fringes of the western Mediterranean Sea, particularly Spain and Morocco, where it may form dense colonies in waste places. It becomes less common in eastern regions of the Mediterranean. Next to the genus *Washingtonia*, this is probably the most commonly grown palm in California. There are two nice specimens in Seattle in front of the comfort station at the

Mediterranean fan palm, Chamaerops humilis. *photo: author*

Dune vegetation on St. Catherine's Island, South Carolina, showing Sabal palmetto Serenoa repens *and* Yucca aloifolia. *photo: author*

Carl S. English Gardens, where they receive protection along a south facing wall.

The Mediterranean fan palm is most often seen as a short, clustering palm with many crowns of stiff, green to gray-green leaves. In favorable climates these clumps may reach 10-12 feet with as many as a dozen stems. This plant, like the Chusan palm to which it is closely related, often has a dense coating of fibers on the trunk. The leaves are palmate, very stiff, and deeply divided into segments, nearly to the petiole. A good way to distinguish young plants of *Trachycarpus* from *Chamaerops* is by the stiff, forward pointing spines on the petioles of the latter. The leaves of the Chusan palm are larger, form a more complete circle, and are not nearly as stiff as those of *Chamaerops*.

Given its native habitat, one can accurately speculate on the conditions needed for the successful cultivation of the Mediterranean fan palm. The hotter the location, the better. It also prefers a well drained soil and may do better in those with a neutral or slightly alkaline reaction. This plant is adapted to winter rain conditions and is very drought tolerant, in fact, summer irrigation may have deleterious effects. The best sites are probably those immediately adjacent to south or west facing walls.

• *Rhapidophyllum hystrix* (Needle Palm)

Closely related to the first two palms, in fact considered a *Chamaerops* at one time, the needle palm, *Rhapidophyllum hystrix,* is native to the southeastern U.S. Although found naturally from South Carolina to central Mississippi and south, the needle palm has been grown with astonishing success as an ornamental in parts of the country far removed from its natural range. There is documented evidence that it has successfully survived nine degrees F in Dallas, Texas with no damage to the foliage (Hintz, 1978) and only foliar damage to the plant at minus six degrees F in Knoxville, Tennessee (Lubar, 1974). I know of one plant which has been growing quite well in the Green Lake section of Seattle.

The needle palm is a clump forming fan palm which freely produced suckers from the base and may attain a height of no more than three to five feet at maturity. The common name is derived from the black, erect spines mixed with brown fibers which protrude from the top and sides of the stems. The leaves consist of palmate, fan-shaped blades which are deeply divided into segments and held on a slender, toothed petiole. They are usually glossy green on top and silvery underneath.

These plants are rare in the wild and are thought to exist only in relict populations. They usually grow in wooded, wet habitats on calcareous, sandy soils. In the wild they are slow growing, but this is probably due to the light- and nutrient-poor conditions in which they are competitive. I suspect that in our area they should be more vigorous growers in open, sunny sites on well drained soil, provided they receive summer irrigation. The apparent frost-hardiness of the needle palm in other parts of the country bodes well for the successful cultivation of this interesting plant in our area.

• *Sabal minor* (Scrub Palmetto)

Another palm native to the continental U.S., this plant has the broadest range of all of our 14 native species. It can be found along the coastal plain from northeastern North Carolina south to Florida, west to Arkansas County, Texas and up the Mississippi Valley to southern Arkansas (Bailey, 1944). This natural range is not completely immune to severe frosts. On the same garden site in Knoxville, Tennessee as described above, plants of *Sabal minor* were undamaged after a winter chill of minux six degrees F, and seedlings survived two consecutive winters with temperatures of minus zero degrees F and have since matured (Lubar, 1974). I know of plants being grown in private gardens around the Seattle area.

Like the needle palm, the scrub palmetto is clumping and forms large thickets in the wild. The stems, or trunks, can often be seen arching or hopscotching over the ground with a crown of leaves held erect just off the soil. The leaves are palmate or slightly costapalmate (with the petiole extending into the center of the leaf blade) which can give them a partly folded appearance. Like the other fan palms, the leaves are divided into segments about half their width. As the leaves age, these segments often become pendulous. The leaf petioles are much more robust than those of the previous species and flattened on one side. The leaves range in color from a limey green to bluish gray.

The scrub palmetto is usually found in wet, sandy pine scrub habitats. It prefers relatively open sites but also colonizes woods with high, dappled shade. These plants will utilize every ray of Pacific Northwest sunshine they can get. Throughout their native range they are subjected to hot, humid summers with frequent rain storms. Well-drained soils with a provision for summer irrigation are probably in order for plants grown in our area.

Another member of the genus, *Sabal palmetto*, the cabbage palm, with a more restricted natural range in the southeast, could also be considered a prospective candidate for our gardens although those gardeners I know who have tried it have had some problems. It should be given the same conditions described for *Sabal minor*.

• *Butia capitata* (Jelly or Butia Palm)

This is the only pinnate-leaved palm of this semi-hardy group with which I have had some experience. There are other pinnate-leaved taxa which have promise in our area as well, but for the moment, I am only comfortable considering this one. The jelly palm is native to cool, dry sites in southern South America but is widely grown as an ornamental. It is commonly found in the landscape of the coastal plain in the southeastern U.S. It is cultivated as far north as the outer banks of North Carolina.

The jelly palm is an arborescent species that may reach as high as 20 feet in favorable locations. The trunk is conspicuously studded with the old, stout leaf bases, giving it a washboard-like texture. The leaves are pinnately compound, often four to seven feet long and of a distinct blue-gray color. They are held in a distinctly arching manner on stout petioles having spines along their margins. In addition, the leaflets are directed upward giving the leaves a

The jelly palm, Butia capitata. *photo: author*

As a landscape feature, the cabbage palm, Sabal palmetto, *at Brookgreen Gardens, South Carolina.* *photo: author*

characteristic V-shape.

This plant will probably require the protection of a courtyard or a south/southwest facing corner close to the house. It should be quite drought-tolerant once established. The sunniest possible exposure will also bring out the best blue-gray color in the foliage. As for the other palms recommended, provide the jelly palm with a well-drained soil.

Once you have taken the plunge and obtained some palms to try in your garden, to the scoffing amusement of curious neighbors, how should you go about using them? Don't let the fear of creating an incongruous landscape inhibit your instincts. However, keep in mind that palms do seem to work better with other bold or tropical-looking companions. Palms and birch trees would be sharply incongruous. To start with, evergreen companions are probably best unless, of course, palms will be used as specimens or in a homogeneous group, for which they are very useful. Palms are often used as single sentries flanking entryways or walks and as individual specimens. I find this a trite and often inappropriate arrangement for the home landscape where several individuals in a group are more appealing.

Palms have a landscape texture which can be manipulated according to the texture of their companions. Depending on the individual palm in use, they can often appear coarse and broad-leaved with other, similar plants such as *Acanthus mollis*. On the other hand, with grassy or narrow-leaved companions they can appear finer textured and livelier. Unless you are deliberately trying to create a tropical effect, consider palms as simply another bold, texturally interesting landscape plant with some special contextual considerations. They are particularly striking next to water, such as ponds or swimming pools.

Palms bring a tropical flavor to the feast that is our garden. If you are in the mood for a new garden taste treat, give 'em a try. Information on these interesting plants, along with sources, can be obtained from the Elizabeth C. Miller Horticultural Library at the Center for Urban Horticulture, University of Washington. An additional source of information, plants, and camaraderie with other palm enthusiasts is the International Palm Society. Contact the Puget Sound Chapter through Mr. John Spaulding, 2401 W. Armour, Seattle, (206) 285-7297.

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In The Arboretum

The year 1988 continues to be an active one around the Arboretum grounds. Recent projects include improvements in the rock garden and the woodland garden, continued work on the winter garden and the greenhouses.

Our staff has worked extensively on the renovation and replanting of the rock garden at the south entrance of the Arborteum. Many new and interesting plants have been installed and the site has been improved for easier use and viewing. Several woody plants from the south side of the greenhouse were relocated at the rock garden. These improvements were supported in part by a gift from the Madison Park Garden Club.

The Woodland Garden has taken on a new look with the addition of three beds filled with moisture-loving plants, including primroses, iris, astilbe, trillium, and royal fern. These beds were developed by our staff, assisted by the creative efforts of Pamela Ware, a volunteer who worked on similar plantings while employed at Wisley Garden in Great Britain. We're using temporary fencing to protect the new plants while they become established. It also appears that we may need some permanent means of protecting stream side plantings from being trampled by visitor and dog traffic.

A pair of Chinese windmill palms, *Trachycarpus fortunei*, 12 and 18 feet tall, now grace the entrance to the Arboretum greenhouse.* These fine specimens were donated by a resident of West Seattle. Our staff hand-dug and transported them—no small feat for trees of this size! They appear to have taken the move quite well.

Renovation work on the greenhouse is still in progress. The shell was put up this past spring. It is made of a polycarbonate material called Lexan, chosen because of its exceptional durability and insulation qualities. Work on the headhouse and the greenhouse benches still needs to be completed before the greenhouse will be operating again. We are currently working with the City of Seattle Parks & Recreation Department on improvements for the headhouse.

Renovation work to improve the drainage on Azalea Way is scheduled to begin this summer, under the "Seattle 1-2-3" funding for park's improvements. The entire length will be stripped, graded, tiled for drainage, resurfaced, and seeded. It will be fenced off for approximately nine months while the new turf becomes established. We can look forward to greatly improved accessibility along one of the Arboretum's most popular treks. Meanwhile, there will be full access to all the other trails and collections.

Work on the Winter Garden continues with soil preparation this summer, followed by planting in the fall. We've begun some preliminary work on the Sorbus collection, which will continue full bore as the Winter Garden is completed.

Two student interns joined the Arboretum staff this summer. Miek van Rossem, a horticulture student from Holland, volunteered for her ten week internship here. Ruth Verduyn, a horticulture student at Washington State University, is working here as part of our annual internship program. Both students will gain college credit for their work experience. The Arboretum has benefited greatly from their efforts and enthusiasm.

There have been several changes in the Parks Department staff at the Arboretum. Bob Baines, Senior Gardener, transferred to the Northeast District in March. The new Senior Gardener is John Candy. John has worked for the Parks Department Horticulture Unit for eight years where he has been involved in all aspects of landscape installation and maintenance, as well as working several years

Continued on page 26

* [See *Palms for the Pacific Northwest*, this issue.]

A Masterful Scheme

Symbiotic Nitrogen-Fixing Plants of the Pacific Northwest

BERNARD T. BORMANN

Mr. Bormann is the Principal Plant Physiologist with the USDA Forest Service at the Pacific Northwest Research Station in Juneau, Alaska. His current research centers on understanding forest ecosystems and determining the effect of forest management on the long-term productivity of the forests of the Pacific Northwest and southeast Alaska.

A masterful scheme has evolved in a few higher plants that is a type of symbiosis. In this case, it is a close, mutually beneficial association between higher plants that produce energy, and nitrogen-fixing bacteria. The root hairs of these plants form into nodules when infected by these specific nitrogen-fixing bacteria. Photosynthetic sugars produced in the foliage are transported to the nodules, supplying the energy to support the activity of a bacterial enzyme, which in turn produces nitrogenous compounds useful to the plant and ultimately, to people.

Why is nitrogen fixation important?

Nitrogen is thought to be the most important nutrient element limiting plant growth in the Pacific Northwest. Nitrogen is a major component of all amino acids, proteins, enzymes and chlorophyll. Plant growth slows when the demand for nitrogen exceeds the ability of the soil to supply it. While other nutrients such as phosphorus and potassium can be derived from the breakdown or weathering of rocks and minerals, nitrogen is not derived in significant quantities from this source. Pacific Northwest rain, although usually plentiful, contains only trace amounts of nitrogen (adding only about 0.5-5 kig of nitrogen per hectare every year). To make matters worse, nitrogen is more easily lost than many nutrient elements. Nitrogen in organic matter is released as a gas when combusted; thus intense wildfires and slashburning can greatly deplete nitrogen reserves from a forested area. Further, as plant residues decompose, nitrate (NO_3) can be produced and sometimes lost by leaching below the rooting zone. Nitrates can also be reconverted to nitrogen gas by denitrifying bacteria, such as *Pseudomonas* spp.

How is nitrogen "fixed"?

Paradoxically, nitrogen is abundant in gaseous form; it makes up 79 percent of the air we breathe. But the gas is unavailable to higher plants and most microorganisms because of its great molecular stability. Gaseous dinitrogen (N_2) consists of two nitrogen atoms held very tightly by a strong triple bond. A few microorganisms have developed a very special enzyme, called *nitrogenase*, that has the ability to break this bond, adding hydrogen to form ammonium (NH_4) that can then be used by plants and microorganisms. This process is called nitrogen fixation. This complicated reaction requires the

Flowers of Purshia tridentata, *Kittitas County*. *photo: B.O. Mulligan*

rare heavy-metal element molybdenum as a catalyst. Thus, molybdenum deficiency can cause an indirect nitrogen deficiency in nitrogen-fixing microorganisms.

Why do these nitrogen-fixing microorganisms not proliferate to the point that nitrogen is no longer limiting? Part of the answer lies with the amount of energy needed to support the process. To fix 1 gram of nitrogen, an estimated 10-100 grams of glucose is required.[1] Most microorganisms rarely have energy resources to produce large amounts of fixed nitrogen. Higher plants can produce excess energy through photosynthesis, but they cannot produce the necessary enzyme.

Which plants fix nitrogen?

Two groups of symbiotic nitrogen-fixing plants are recognized. Many members of the pea or legume family form a symbiotic association with *Rhizobium* spp. bacteria. Several other genera of woody perennials associate with actinomycete bacteria. This second group is known as actinorrhizal plants. Some lichens (for example the common foliose lichen *Lobaria oregana*) are formed through a symbiotic relation between a fungus and a nitrogen-fixing blue-green alga (*Nostoc* spp.). Some of the more important nitrogen-fixing plants in this region are listed in Table 1.

Role of nitrogen-fixing plants in Pacific Northwest ecosystems

Nitrogen-fixing plants have played a key role in developing and maintaining Pacific Northwest ecosystems. Red and Sitka alder (*Alnus rubra* and *A. sinuata*) pollen is found in great abundance in sediments corresponding to a period of early plant development after the Wisconsin glaciers left the Puget Sound area some 12,000 years ago. If we assume that throughout the post-glacial period precipitation was low in nitrogen, as today, and that there

[1] Gutschick, V.P. 1978. Energy and nitrogen fixation. *Bioscience* 28(9):571-575.

were at least a few wildfires, much of the 5,000+ kg of nitrogen per hectare often found on forested sites probably originated through nitrogen fixation by alder. Sediments in Lake Washington have shown a resurgence of alder pollen corresponding with land clearing and logging during the early development of Seattle.[2] Most nitrogen-fixing plants are adapted to disturbance. *Ceanothus* spp. dominates many sites in the Oregon Cascade Range after burning. Many introduced legumes like Scotch broom (*Cytisus scoparius*) come in after soil disturbance from logging or along roadsides. The ability to fix nitrogen gives these plants a competitive advantage on nitrogen-deficient soils, although many also do well on non-nitrogen-deficient soils.

Important uses for nitrogen-fixing plants in agriculture and forestry

Currently, two percent of world fossil-fuel production is used in direct manufacture of nitrogen fertilizer. Increased use of nitrogen-fixing plants in agriculture and forestry could reduce this dependency. Because the cost of fossil-fuel-derived nitrogen fertilizer has decreased in recent years, it is important to find nitrogen-fixers that have economic value in addition to the value of the nitrogen they fix. This will be less important when energy prices increase again.

Agricultural legumes such as soybeans, alfalfa, lentils, and clover require little or no nitrogen fertilizer and provide valuable protein-rich foodstuffs. Rangeland management to pro-

Foliage of red alder. *photo: B.O. Mulligan*

[2] Davis, M.D. 1973. Pollen evidence of changing land-use around the shores of Lake Washington. *Northwest Science* 47(3): 133-148.

Red alder, Alnus rubra

Red alder, Alnus rubra, *can form large nodule clusters, some as large as a baseball.*

Scientific Name	Common Name	Range	Native / Introduced
Leguminous plants			
Cytisus scoparius (L) Link	Scotch broom	CW	I
Lathyrus latifolius L.		REG	I
Lathyrus nevadensis Wats.		CE	N
Lathyrus polyphyllus Nutt.		REG	N
Lotus crassifolius (Benth.) Greene	Pink trefoil	CW	N
Lotus micranthus Benth.	Slender trefoil	CW	N
Lupinus albicaulis Dougl.	Silky-stemmed lupine	CW	N
Lupinus albifrons Benth.	White-leaved lupine	CW	N
Lupinus latifolius Agardh		REG	N
Lupinus laxiflorus Dougl.	Spurred lupine	CW	N
Lupinus lepidus Dougl.		CW	N
Lupinus micranthus Dougl.	Small lupine	REG	N
Lupinus polyphyllus Lindl.	Large lupine	REG	N
Lupinus rivularis Dougl.	Riverbank lupine	REG	N
Lupinus sulphureus Dougl.	Oregon lupine	CW	N
Medicago hispida Gaertn.	Bur clover	REG	I
Medicago lupulina L.	Black medic	REG	I
Psoralea physodes Dougl.	California tea	REG	N
Trifolium bifidum Gray		REG	N
Trifolium ciliolatum Benth.		CW	N
Trifolium dubium Sibth.	Small hopclover	REG	I
Trifolium eriocephalum Nutt.		REG	N
Trifolium gracilentum T.&G.		CW	N
Trifolium hybridum L.	Alsike clover	REG	I
Trifolium longipes Nutt.		CW	N
Trifolium microcephalum Pursh	Small-headed clover	REG	N
Trifolium microdon H.&A.	Cup clover	CW	N
Trifolium oliganthum Steud.		CW	N
Trifolium pratense L.	Red clover	REG	I
Trifolium procumbens L.	Hop-clover	REG	I
Trifolium repens L.	White clover	REG	I
Trifolium tridentatum Lindl.	3-toothed clover	CW	N
Trifolium variegatum Nutt.		CW	N
Ulex europaeus L.		REG	I
Vicia americana Muhl.	Wild pea	REG	N
Vicia gigantea Hook.	Giant vetch	CW	N
Actinomycete-nodulated (actinorrhizal) plants			
Alnus incana (L.) Moench	Mountain alder	CE	N
Alnus rhombifolia Nutt.	White alder	CE	N
Alnus rubra Bong.	Red alder	CW	N
Alnus sinuata (Regel) Rydb.	Sitka alder	CW	N
Ceanothus cuneatus (Hook.) T.&G.	Common buckbrush	CW	N
Ceanothus integerrimus H.&A.	Deerbrush	CE	N
Ceanothus prostratus Benth.		CE	N
Ceanothus sanguineus Pursh	Buckthorn	REG	N
Ceanothus velutinus Dougl.	Mountain balm	REG	N
Cercocarpus montanus Raf.	Mountain-mahogany	CE	N
Dryas drummondii Richards.	Dryas	REG	N
Dryas octopetala L.		REG	N
Myrica californica Cham.	Pacific wax-myrtle	CW	N
Myrica gale L.	Sweet gale	CW	N
Purshia tridentata (Pursh) DC.	Bitterbrush	CE	N
Shepherdia argentea (Pursh) Nutt.	Thorny buffalo-berry	CE	N
Shepherdia canadensis (L.) Nutt.	Soapberry	REG	N

Ranges are: **CW**—Cascades westward; **CE**—Cascades eastward; **REG**—regional

Table 1.) Common nitrogen-fixing plants of the Pacific Northwest (from Hitchcock, C.L. and A. Cronquist. 1974. *Flora of the Pacific Northwest*).

Mountain balm, Ceanothus velutinus *near Leavenworth, Chelan County.* *photo: B.O. Mulligan*

mote nitrogen-fixers such as bitterbrush (*Purshia tridentata* Pursh) could increase soil fertility and provide protein-rich forage for wildlife and cattle of the Great Basin. Native legumes could be established after logging to improve forage quality for coastal wildlife species. Red alder may become a more important part of forest management on the west side of the Cascade Range because it has one of the highest nitrogen-fixation rates known (50-150 kg/ha annually) and because of the moderately valuable wood it produces.

Summary

Natural sources of nitrogen in rainfall are usually inadequate to meet the demand of growing plants and thus limit their productivity. As a consequence, nitrogen-fixing plants can play a vital role in maintaining the fertility of Pacific Northwest ecosystems. Understanding more about the process of nitrogen fixation and how nitrogen-fixing plants interact with other plants will help to develop sustainable management of forest and agricultural ecosystems.

Editor's Note:

Refer to the Winter, 1987, issue of the *Arboretum Bulletin*, page 4, for more information on nitrogen-fixation in connection with the Leguminosae.

The President's Report

of the Arboretum Foundation

ELIZABETH MOSES

A review of the Arboretum Foundation's 53rd year shows continued fulfillment of the Foundation's stated objective: "... with the Unit Council, to promote, foster and assist in the establishment, development, growth and maintenance of an Arboretum... in Washington Park." We have enjoyed our usual dividend of education for ourselves and a growing segment of Puget Sound's citizens.

A major mission for the Foundation is the funding of donations to the Washington Park Arboretum and its programs. Last year these included:

- Renovation of the Winter Garden and Sorbus Collection—$30,000
- Continued support for the Curator—$10,000
- Salary for a graduate student's work in the Herbarium—$13,000
- A labeling machine for tags on Arboretum plants—$6,312
- Help with expenses of the Curator's trip to New Zealand—$1,000
- Pledged maintenance of the Memorial Garden—$1,500
- In the Japanese Garden, a new sound-reducing fence and repairs in the Tea House—$6,240

Proceeds from the Unit Council Bulb and Spring Plant Sales, totaling $44,000, were also donated; profits achieved by thousands of hours spent by hundreds of hard working volunteers.

Not all of our support is monetary. In our role as watchdog for our favorite garden, we have participated in City meetings on future bike trails in or near the Arboretum and on preliminary studies for increased passenger capacity of the Evergreen Point Bridge corridor. The Center for Urban Horticulture uses our informative Bulletin as an exchange publication with other Arboreta. Our volunteers help with the CUH's seed exchange and herbarium collection, with the guide program, and at the Graham Visitor Center reception desk.

A public that uses and enjoys the Arboretum is necessary for our mission and survival. We facilitate that mission in many ways: with our many sales (Bulb, Greens Galore, Used Book, Spring Plant) and year-round gift shop and greenhouse; with the time volunteered by our helpful receptionists and gift shop staff; and with informative programs offered monthly and

without charge to our members and the general public. Our energetic members have searched the community for interested gardeners and have formed two new units, with eight more in the process of being formed.

"Saplings," an outreach project that has served 2,120 children from 24 schools so far, was launched last fall. Sixty volunteer guides, instructors and hostesses made each child's visit informative and enjoyable. Our member guides continue to lead scheduled and requested tours in the park.

Our sponsorship of Barry Ferguson, renowned floral designer and lecturer, offered a unique opportunity for our members and the public to enjoy both his wit and his creation of stunning arrangements from local flora. Our new portable booth designed and constructed by volunteers made participation much simpler in community horticultural events—CUH's Open House, Seattle Flower Show and Bellevue's Market Place.

Our Pat Calvert greenhouse continues to propagate unusual plant material and train greenhouse workers. Individual Unit meetings and study groups expand members' knowledge of botany and horticulture, which may then be shared at our many public events.

There are some committees whose work is not as easily visible as others, but is nonetheless as vital. The Finance Committee pondered and prioritized, then thriftily budgeted and invested our funds. The Awareness and Publicity Committee now meets with each event chairman to plan Foundation publicity. A Long-Range Planning Committee has been meeting to develop a wise growth plan. The Membership Committees have worked diligently to find appropriate Units or activities for each of this last year's more than 400 new members. The House Committee sees to the numerous details that are needed to keep the GVC operating smoothly.

At year's end, it is appropriate to consider what lies ahead. We anticipate new "Saplings" visits and on February 16, 1989 a very special party for all our members and friends. The Preview Party for the 1st Annual Northwest Flower and Garden Show will be hosted by the Arboretum Foundation on that day in the new Washington State Convention & Trade Center. Proceeds will be used for improvements on Azalea Way. [See "In The Arboretum" in this issue.] We will help with the Washington Park Arboretum's 500 square feet display garden at the show, generously funded by a grant from U.S. Bank. Our gift shop will have a booth and we will participate in the educational events.

We look forward to the arrival of the new GVC manager and program assistant, Linda Ramsley, in July, and to the new year in general, knowing there will be surprises, pleasurable and difficult. With our members' generous gifts of skill and devotion, we will be equal to any challenge.

Elizabeth Moses
President

The Spry Container Gardener

GEORGE SCHENK

Mr. Schenk is a well-known plantsman/author who divides his time between the Seattle area and New Zealand. He is the author of Rock Gardens *and* The Complete Shade Gardener.

With age, I find that long leaps backward or forward in time have become easy and entertaining. I begin to envision myself in advanced years, a nonagenarian, out planting species new to me. My vision undoubtedly owes something to that after-dinner yarn of old-time inspirational speakers, the one about the philospher who decides to spend doomsday hoeing his garden (the story has several versions). Now, if I'm lucky enough to reach bright-eyed antiquity, I know just how I'm going to plant everything. In containers.

In fact, I've begun. More and more I find gardening in containers suits my abiding love of plants in variety. That love grows more circumspect these days, as the old work horse in me grows more balky at the mere thought of the mountainous labor involved in the open-ground cultivation of plants in the hundreds, even thousands, of varieties I would yet grow and study. In a life-time of gardening I must have shoveled, screened, blended, and spread home-made loam equal in volume to a good-size house. (I distrust the airy commercial planting mixes; they are perfect for nursery purposes, but with the average imprecise watering routine of the home garden, the planting mix goes dry and kills more plants than any disease or insect.)

My old horse-self has stayed in pretty good shape owing to my working of the soil. I recommend the means. But I feel the time has come when I might with a certain amount of self-respect hang up my shovel in the den as a trophy of the past. Anytime now. Next year maybe. And then my number one digging tool will be a trowel used to convey earth to pots and planter boxes. Container gardening miniaturizes the work of gardening, by helping to keep plants small and easily manageable. The principle, as you've probably observed, is that restriction at the root somewhat—or largely—restricts the plant's growth at stem and branch.

Ground Covers

FRANCES KINNE ROBERSON

This article was originally printed in the Arboretum Bulletin *in the summer of 1962. Frances Roberson is a long-time pillar of the Seattle plant and garden community. She was on our Editorial Board for years, was a founding member of the NW Chapter of the American Rock Garden Society, operated the L. M. Roberson Nursery, and has been involved with numerous local plant societies. Consider this reprint a small tribute to a friend and learned colleague.*

To the American Rock Garden Society, Frances Roberson is our very own walking encyclopedia of all thing horticultural, historic, or grammatic. With her vast fund of ready information, she has a talent for making one feel, not stupid for having to ask, but clever for wanting to know. She shares her time and experience with the beginning gardeners as well as the professionals from the city, the campus, and the nurseries.

Frances speaks, writes, and thinks clearly, precisely, and interestingly. She has been a role model for every so many of today's and tomorrow's horticulturists and for her many friends of all ages from the Arboretum Foundation, the American Rock Garden Society and the horticultural world around us.

Countries have their national treasures. We have Frances Roberson.

Nan Ballard

I first met Frances Roberson in 1955 through a young man who supplied the rocks and installed our first "rockery" for $80. When I told him I wanted to acquire lots of hens and chickens (a sentimental attachment from a midwestern childhood), he gave me Frances' address and assured me that she would be able to provide them.

Of course I came away from my visit to her nursery with several different kinds of treasures as well, including *Potentilla nepalensis* 'Willmottiae' and *Geranium sanguineum* var. *lancastriense*. The latter still flourishes in pockets around our garden. As I think back, I realize that this first contact was indicative of Frances' talent for teaching as well as her generosity in sharing her great knowledge with even the barest beginner. These things, as well as her warmth and her willingness to undertake extra responsibilities have made her beloved in the plant community.

The following article was written in 1962, succeded a year or two later

Andromedia polifolia. *photo: Don Normark*

by a lecture to the Arboretum Foundation Unit Council. On that occasion she brought in and discussed over 100 different kinds of ground covers which she allowed the audience to purchase afterwards at ridiculous low prices. The ensuing melee was unforgettable. At one point two elderly ladies engaged in a tug of war threatening to tear apart a "sod" of native materials. When Frances said, "Don't do that. You'll kill it!", they replied, "We don't care. We each want half." Frances kept her cool. Is it a coincidence that the expression "down to earth", which occurs at the end of the second paragraph, is one of the first descriptive phrases I thought of when I was trying to characterize Frances Roberson's special qualities?

Jan Pirzio-Biroli

A new approach to the subject of ground covers would be hard to discover since they have been the basis of so many excellent articles in the *Arboretum Bulletin* and other publications. But repetition of familiar names may serve a useful purpose in refreshing our memory about old friends and neglected possibilities among the many attractive ground cover plants suitable for various landscape situations.

A ground cover plant may be purely utilitarian to prevent erosion, to protect the roots of other plants from sun, to eliminate the lawn

mowing chore, to discourage weeds, or simply to fill up space which does not lend itself to any other type of planting. Or, aesthetic considerations may be prime factors when selecting a ground cover. The effectiveness of landscape design may be increased by ground covers which join various units, or soften harsh lines, or bring a taller planting "down to earth."

Not only do we need to familiarize ourselves with the hardiness, soil requirements and light preferences of plants under consideration so that they may be well grown but we must also be sure that the foliage, flower and fruit—if any—harmonize with other plants and present a pleasing appearance. Color, texture, persistence and size of leaf are important. Color, texture and size, as well as season of flower, warrant consideration.

Material for ground cover use embraces wide choice among (1) herbaceous perennials, both the very low, mat-forming ones and the taller, loose-growing types; (2) shrubs, either deciduous or evergreen, broad-leaved or coniferous; (3) vines; (4) bulbs and corms; (5) annuals and tender perennials; and (6) ferns. Shrubs have the advantage of greater permanence and are by no means lacking in variety. Perennials would be almost equally diverse and useful.

Azaleas, gaultherias, dwarf rhododendrons, huckleberries and related plants are particularly adapted to use with large rhododendrons.

Any of the varieties of *Andromeda polifolia* will hang out soft pink bells on twiggy stems a few inches to a foot above the mats of intertwined roots in April. Moist but well-drained peat suits them best. The dark green leaved variety, *A. p. montana,* vies with the gray leaved one, *A. p. 'Nana Compacta,'* in popularity. Propagation is usually by division but may be by cuttings or seeds.

A close relative, sometimes listed as *Pieris* or *Andromeda nana*, is *Arcterica nana*, a veritable pygmy of only three or four inches in height with fragrant cream-colored flowers in drooping clusters. Rooted portions may be detached to establish new plants. Cuttings root easily also.

The double salmon flowers of *Rhododendron indicum* var. *balsaminaeflorum (Azalea rosaeflora)* seem to smother the low compact bushes of bronzed hairy leaves when at their best. The flower color varies slightly with soil conditions so that care should be exercised in using this plant or its single-flowered counterpart, 'Flame Creeper,' as a ground cover below shrubs which bloom at the same season. The low branches often layer themselves in peaty soil under the plants.

Any azaleas of low habit, such as 'Hinodegiri' or 'Gumpo' if used in sufficient mass to be in proper scale, may be considered ground covers. Year-round appearance of the foliage increases in importance if the planting occupies a conspicuous place in the garden. The prodigal display of bloom lasts such a short time in comparison with the perpetual show of the foliage that the latter becomes especially important.

Heathers assume a prominent place in any list of ground covers for the northwest. A good all-year appearance is a virtue of many low growing ones. A sequence of winter bloom which embraces several months is possible with *Erica carnea* and its varieties. *E. c.* 'King George' usually opens its rosy-mauve flowers in December when they literally cover the somewhat rounded mats of bright green foliage. Flatter mats characterize succeeding groups: *E. carnea* itself with clearer rose flowers in January, 'Springwood' with lighter green foliage and snowy flowers, then 'Springwood Pink' whose pink buds take on a rosier hue as they open, and, lastly, 'Vivellii' or 'Ruby Glow' with bronze tints to the foliage and crimson flowers. In addition to these winter heaths a long list of summer flowering heaths for ground covers might be compiled from reference sources readily available. Suffice it to say here that the range of flower color and form, as well as foliage texture and plant habit, extends to distracting variations. Generally speaking successful culture of heathers is achieved with sunny exposure, peaty soil and moderate moisture.

The genus *Gaultheria* offers a large number of excellent ground covers for moist, partially shaded situations. One of the best known, *G. procumbens*, Wintergreen, is a native of the eastern United States, has handsome burnished oval leaves of more than an inch in length and bears scarlet fruit. Two northwestern natives, *G. humifusa* and *G. ovatifolia,* also have scarlet berries. These appear as miniature forms of Salal. The rounded, bristly-edged leaves of *G. nummularioides* vary in color from old rose when newly unfurled to bronze when mature.

Rhododendron pemakoense. *photo: E.F. Marten*

The prostrate stems mold themselves to the contour of the ground, each one controlling its string of coin shaped leaves. Two white-berried Asiatics are *G. cuneata* and *G. miqueliana*. Customary propagation of gaultherias is by cuttings in spring but of course they may be grown from seeds.

The huckleberry tribe provides us with one of the most adaptable of broad-leaved evergreen ground covers, *Vaccinium vitis-idaea,* known as Lingonberry when its tart red fruit is sold commercially for jam or for pie filling. Creeping stems enable these plants to cover densely an area in which they have been spaced some distance apart.

These two small-leaved treasures are certainly of ground cover value if it is possible to establish their creeping mats in sufficient quantity to serve such a purpose; *Empetrum nigrum* (Crowberry) noted for its blue-black fruit, and *Loiseleuria procumbens* (Alpine Azalea) at its best when the foliage is practically obscured by small flowers of pink or of white tinged pink. Moist, well-drained peaty soil suits either plant.

Pernettya offers a wide range of sizes and some choice in color of berry. The tangled two-foot-high thickets of *Pernettya mucronata* will serve a double purpose when used as a ground cover in an exposed area where it will also discourage trespassing because of its prickly leaves. *P. leucocarpa*, on the other hand, requires a more secluded area where it will create a miniature thicket of only a few inches in height. An interesting natural cross between *Gaultheria* and *Pernettya* is *Gaulnettya wisleyensis.*

Rhododendron pemakoense, from one to two feet in height, covers well because of its stoloniferous runners. The mauve flowers are more than an inch across but may suffer from frost unless the plants are located in a protected spot. *R. radicans* is much lower to the ground, has narrower dark green leaves and purple flowers. The stems may root readily by self-layering but they do not travel underground. These and other dwarf rhododendrons such as

R. kelectium, R. racemosum, R. williamsianum and a host of others will usually stand considerable sun but need plenty of peat moss in the soil and should never dry out around the roots.

Dry banks demand an entirely different type of plant, chief examples of which are brooms, sun roses and rock roses *(Cistus)*. The brooms vary in height from the prostrate *Genista sagittalis*, called arrow broom because of its three-angled stems, to *Cytisus praecox* 'Moonlight' of several feet in height unless pruned unmercifully. Intermediate ones include *C. purpureus* with its gracefully arching branches of a foot or so in height; *C. versicolor,* of two to four feet, with a creamy flower which fades to purple; procumbent *Genista pilosa* with yellow flowers, and *G. radiata* which makes an enormous rounded shrub whose soft-tipped shoots belie their barbed appearance. Cuttings of brooms taken in May root easily but young plants should be kept potted until set in their permanent site since the roots would otherwise wander and suffer in transplanting. Poor soil is no deterrent to growth of any of these plants.

Another legume adaptable to poor soil conditions is *Lotus corniculatus*, bird's foot trefoil, a yellow-flowered perennial forming bright green mats in summer but dying back to ground level in winter. Its intertwined roots increase the nitrogen content of the soil while preventing erosion.*

Sunny areas where a little better but not rich soil prevails will take on an interesting appearance if covered with flat shrubs such as *Arctostaphylos uva-ursi* (Bearberry or Kinnikinnick), *Cotoneaster humifusus*, or *Ceanothus prostratus*. These three shrubs may even be combined in large drifts. The first two would flower in spring and have red fruits in autumn. The powder blue flowers of *C. prostratus* would enliven the setting in early summer.

Old friends, among plants as among people, are often best. Shady tracts planted with *Vinca minor, Hypericum calycinum, Pachysandra terminalis, Ajuga reptans* 'Rubra' or *A. genevensis* (green-leaved) please the eye and serve their landscape purpose better than a spotty conglomeration of diverse or difficult subjects.

A special effect may be created by using white-flowered plants such as *Asperula odorata, Epimedium niveum* or *Omphalodes verna* 'Alba.' The dappled shade of woodland glades is a proper setting for *Campanula poscharskyana, Corydalis lutea, Oxalis oregana, Primula sieboldii* and other perennials. Each species should be planted in an impressive quantity to give a ground cover effect.

Paths and paved areas need plants adaptable to foot traffic without suffering harm. In addition to *Thymus serpyllum* and *Sagina subulata* for this purpose there is an interesting representative of the *Rosaceae, Acaena glauca,* for sunny walks. More unusual but useful additions to this list would be *Bellium minutum, Gentiana acaulis, Dianthus graniticus, Pimelea coarctata, Raoulia australis, Silene acaulis* and *Veronica repens. Acaena microphylla, Arenaria balearica, Cotula squalida* and *Mentha requienii* serve the same purpose in shade.

The selection of the proper ground cover for a certain location is complicated more by the wealth than by the dearth of material from which to choose. Reference to books, magazine articles and catalogues, coupled with personal observation and ingenuity, will reward any gardener with satisfying effects.

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* [See *A Masterful Scheme*, this issue.]

Looking for Dead Wood

CASS CLELAND TURNBULL

One of the great secrets of successful pruning, and the only hard-and-fast rule is to prune out the dead wood. Dead wood has an amazing subconscious impact on me, making the landscape seem messy and dirty; I would estimate that 80% of my work as a professional gardener involves pruning dead wood. You cannot hurt a plant by taking it out and there is no correct season for doing it. It is a task most appropriate to the old pruning dictum: prune when the shears are sharp.

Summer is a good time to prune out dead wood on deciduous plants, especially the small-leaved, fine-branched ones. In winter, it is more time-consuming to sort out which branch is dead on shrubs such as azaleas, viburnums and lilacs. In the summer you only have to note which branches are leafless.

Winter can be a useful time to prune large-leaved deciduous plants. Since the leaves have dropped off, you can see all the branches and get the "big picture." It is also the slow time of year for professional gardeners, and a good time to do major structural work.

New gardeners will have to train their eyes to see dead wood. But once they have developed an "eye" for it, they'll notice it from the freeway at 55 mph. You can tell if a branch is dead, even in winter, because the wood is darker in color and brittle. Gardeners are always bending branches to see if they are dead and brittle and shaking them to see where they go. Sometimes, merely tapping the branches with your pruners will snap them off, although this is risky with some plants, possibly tearing live wood and leaving a wound. But cotoneasters, for example, are easy to clean up in this manner. Remember also that dead branches have dead buds; at any time of year, a healthy plant will have live-looking buds on the tips of branches. Dead buds are smaller, browner and dried-out. Since branches die from the tip back, you will want to cut them back going progressively from the tip towards the base, looking for live wood. Trim back to just above the first live bud. With practice you will be able to see a demarcation line between the two sections. And, finally, you can nick or scratch the branch with your pruners. Green, found just below the bark, means a viable branch, black or brown indicates dead wood. If you do a progressive cut-back, as described, on a diseased branch, you must be sure to sterilize the pruners. Equally important is pruning off any

dead stubs that you may find. These stubs have a profoundly negative effect on the overall appearance, growth and healing of the plant.

Pruning requires a hands-on approach. For larger plants you can use a pole pruner, but for most you have to get into your grubbiest clothes and get on your hands and knees and crawl into the shrub. Look at each major branch separately. Do you spot the dead wood? Sometimes it helps to start from the bottom and work up, following one branch at a time. Don't take just the largest one. Get the tiny twigs too. Be patient. Move slowly. If you are in a hurry, you will probably not do a complete job and you could easily cut accidentally into live wood, or injure yourself. Keep in mind that this initial large-scale clean-up will need to be done only once; pruning will be easier and less time consuming next year.

By now your underwear will be full of twigs and your hair full of bud scales. But, when you have finished (I estimate between one-half and one-and-one-half hours per old shrub) you should walk or crawl outside and see what you have unveiled. I promise you a miraculous improvement on any shrub if you simply prune out the dead wood before you do any other pruning. Many people ignore this step, yet it is a major part of a complete job.

Finish off your pruning job by raking out all the debris around the base of the plant. This is the second great professional secret of successful pruning and the wonder worker here is the fan rake. Raking out the leaves from under trees and shrubs invariably makes the garden or landscape look better. It is especially important to gather the leaves that are blackened or scorched-looking; they might be carrying a disease, and be a source of reinfection in the next year. Destroy them. Don't compost them. In this process of cleaning up you might also destroy slug hideouts, always a bonus in the Northwest.

In some situations, gardeners will rake leaves *into* the beds. The theory here is that the leaves act as a mulch, preventing weeds from germinating, serve as a "blanket," and make good compost for the soil as they eventually decompose. I suggest that ideally you should rake out healthy leaves, shred them, and reapply them to the garden bed. They are, I feel, more presentable and they decompose faster than if left in their natural state. You decide which method you prefer. In any case, remove the mess created by pruning out the dead wood.

Just a word on dead wood and plant health. As a novice gardener I thought the point of pruning was size control. I wondered about all the concern about health and improving air circulation. Now I understand. Plants are served immeasurably by removing the dead wood (and dead leaves), thereby improving air circulation and light penetration, and removing sources of disease and insect infestation. I have brought many plants back from death's door by pruning only the dead wood. Not only do they look infinitely better, but I think their growth rate and their ability to ward off disease is greatly improved. Healthy plants simply look better, and isn't this really the gardener's goal?

Book Reviews

The New Seed-Starters Handbook by Nancy Bubel. Rodale Press, Emmaus, PA, 1988. 385 pages. Price $19.95 ($14.95, softcover).

At last, a really comprehensive and easy-to-use handbook for beginning gardeners who want to get dirt beneath their fingernails. This revision of the 1987 original, with flexible cover, is divided into four main sections, ''Starting Seeds Indoors,'' ''Moving Plants Outdoors,'' ''Special Techniques and Situations,'' and ''Savings Seeds and Making Further Plans.'' The book is written in a logical and progressive manner. Easily referenced, each section contains just the right amount of background information to explain why you should use specific growing techniques. For gardeners with little or not experience, this book will be invaluable.

The original version contained only information on vegetables, but this one has sections on flowers, herbs, trees, and shrubs. It is amply sprinkled with charts and graphs which give all those little details such as ''Tolerance to soil acidity'' (pg. 73) and ''How to figure the last planting date'' (pg. 131), both of vital importance to successful gardening in the Puget Sound area with its usually acidic soils and short cool growing season.

Each section contains timely tips, and even most eastern U.S.A. gardening tips seem to be appropriate for us here. The diagrams are easy to understand and the final sections of the book give lots of additional resources where gardeners can find more information.

One of the most intriguing sections to me covered the aspects of saving your own seeds. Even though seed and plant companies usually discourage us, ''real'' gardeners are always saving seed to grow their own plants. In this section, you'll find such diverse topics as ''Seed Catalogs, Seed Exchanges, and Seed Banks.''

For gardeners who are devoted to organic techniques, the book describes general methods for insect and disease control. In fact, an unusual section describes the use of seaweed for increased garden productivity.

The book contains more specific information on starting vegetables and annuals. The perennial, wildflower, and tree/shrub sections cover the most common types found in all gardens. As experienced gardeners know, each of these topics is a volume in itself.

Don't delay, this book, not of the ''coffee table'' variety, is one every beginning gardener should have. Why not buy more than one and give them as gifts the next time you need one for a ''budding'' gardener?

John A. Wott

A Garden of Roses, Watercolors by Alfred Parsons, R.A. Commentary by Graham Stuart Thomas, consultant to the National Trust. Pavilion Books, Ltd., Great Britain, 1987. 160 pages. Price: £16.95.

This volume is a wonderful collection of plates reproduced from the original watercolor paintings of the roses in the English garden of Ellen Ann Willmott. They were painted by Alfred Parsons over a period of several years and fill pages 20 through 159 of this book with his meticulously detailed watercolors.

Graham Stuart Thomas gives an interesting commentary on the history and development of modern roses, from 1800 (and earlier) until the present. He recounts the hybridizing of *Rosa chinensis,* the China Rose, and *Rosa gigantea*, the Tea Rose, repeat-blooming varieties, with the hardy, one-time blooming species *Rosa gallica, R. moschata*, and *R. phoenicea.* These hybrids were the ancestors of all our modern roses. Thomas also describes the history of collecting old roses, the scientific studies made to determine the parentage of roses, the preserving of the collection of wild species from Miss Willmott's garden, and the influence of the rose on garden design.

The biography of Miss Willmott included in the book, tells of her early years growing up in a well-to-do environment in England, surrounded by hundreds of acres of beautiful gardens. Miss Willmott, along with Miss Ger-

trude Jekyll, received the Victoria Medal of Honor from the Royal Horticultural Society, and Miss Willmott, the Award of Merit for her outstanding roses. But roses were only one of her many areas of expertise. As she became a horticulturist of great renown, with the help of 104 gardeners, she devoted her time to sending out a seed list to all the botanical gardens in the British Isles. They say that she grew 100,000 species and varieties of trees, shrubs, and plants.

Bryan N. Brooke, M.D. has included an interesting account of the history of the original volumes of *The Genus Rosa* illustrated by Alfred Parsons. It involved a traumatic and stressful period of years, during which the temperamental Miss Willmott manipulated publishers and tried to get *The Genus Rosa* printed and recognized in Europe as well as America. The present volume, at long last, gives recognition to Alfred Parsons and his excellent body of work.

Lee Clarke

In the Arboretum Continued from page 9

at the Volunteer Park Conservatory. We are pleased to have John join our efforts in the care and management of the Arboretum grounds.

After more than eleven years at the Arboretum, mower operators Myung Kim and Ray Rohman, Jr. retired this spring. We wish them all the best in their well-earned retirement years. One of the new mower operators is Kevin Anderson, who has been with the Parks Department for nine years. Kevin was promoted to the Arboretum from the West Central District, and has successfully taken on the challenge of mowing the Arboretum's difficult terrain. A second mower operator is scheduled to begin work in early July. We welcome these new people to the Arboretum and look forward to working with them.

Christina Pfeiffer
Horticulturist

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New On The Shelf of the Elisabeth C. Miller Library

VALERIE EASTON

The Garden Design Book, by Anthony Paul and Yvonne Rees. Salem House, Boston, Massachusetts, 1988.

The most attractive of the newer "glossy" design books, this volume successfully combines beautiful photos with practical advice. Included are particularly good examples of hard surfaces and ideas for garden features and framework.

A unique and most interesting chapter compares the work of over a dozen of the most influential internationally-known garden designers. The contrast in styles is fascinating and gives the reader new ideas as to the variety of possibilities in the garden.

Perfect Plant, Perfect Garden: The 200 Most Rewarding Plants for Every Garden, by Anne Scott-James. Summit Books, New York, 1988.

This title has been touted as the successor to *Right Plant Right Place* by Nicole Ferguson (Summit Books, 1984). It is a very different book, however; much more personal and less comprehensive. While *Right Plant Right Place* lists a large variety of plants suitable for specific situations (dry and sunny, hillside, damp, etc.) and gives color photos of many of the plants mentioned, *Perfect Plant* is much more selective, suggesting the "best" plants for different locations. The excellent color photos are included not as much for purposes of identification as they are for design ideas, showing plants in mass plantings, beds, or borders. It is an excellent book, full of ideas and inspiration, but doesn't replace the more complete title by Ferguson.

The Miller Library has collected information on drought-tolerant plants and water-efficient gardening techniques. Bibliographies and a notebook of materials are available in the Library. Please call Valerie Easton at 543-8616 for further information.

Other New Books

Clevely, A. M. *Topiary: The Art of Clipping Trees and Ornamental Hedges.* Salem House, Topsfield, MA, 1988.

Colby, Deidre. *City Gardening: Planting, Maintaining, and Designing the Urban Garden.* Simon & Schuster, New York, 1987.

Horny, Radvan; Webr, Karel Mirko; and Byam-Grounds, John. *Porophyllum Saxifrages.* Byam-Grounds Publications, Stamford, Lincs. (England), 1986.

Loewer, H. Peter. *The Annual Garden: Flowers, Foliage, Fruits, and Grasses for One Summer Season.* Rodale Press, Emmaus, PA, 1988.

Lyte, Charles. *The Plant Hunters.* Orbis Pub., London, 1983.

Ottesen, Carole. *The New American Garden.* Macmillan, New York, 1987.

Polunin, Oleg, and Huxley, Anthony. *Flowers of the Mediterranean.* Hogarth Press, London, 1987.

Rose, Graham. *The Small Garden Planner.* Simon & Schuster, New York, 1987.

Rushforth, Keith. *Conifers.* Christopher Helm, London, 1987.

Wenpei, Fang, ed. *Sichuan Rhododendron of China.* Science Press, Beijing, 1986.

Wilson, E. O., ed. *Biodiversity.* National Academy Press, Washington, D.C., 1986.

Young, Michael. *Collins Guide to the Botanical Gardens of Britain.* Collins, London, 1987.

All of these books can be found in the Elisabeth C. Miller Library, Center for Urban Horticulture, 3501 N.E. 41st Street. The Library is for reference use only; a copy machine is available for public use. Hours are 9-5, Monday–Friday.

Special thanks to the individuals and organizations who have contributed these books to our library.

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